REMARKS

This amendment is submitted in response to the outstanding Office Action, dated October 24, 2003. The present application was filed on December 28, 2001 with claims 1-21. Claims 11-21 have been withdrawn from consideration in response to a restriction requirement. Claims 1-10 are therefore presently pending in the above-identified patent application. The specification has been amended at pages 2, 3, 9, 10, 12 and 13 to correct typographical errors and claim 8 has been amended to clarify terms appearing therein.

In the Office Action, the Examiner objected to the specification based on several typographical errors appearing therein. The Examiner objected to claim 8 for alleged informalities appearing therein. In addition, the Examiner rejected claims 1-10 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention, due to an alleged indefinite use of the term "substantial," and also for use of "said first insulating layer" without providing an antecedent basis for the term.

In addition, the Examiner rejected claims 1-3, 5, 6 and 8-10 under 35 U.S.C. §102(e) as being unpatentable over U.S. Patent No. 6,329,234 issued to Ma et al. (hereinafter "Ma"). The Examiner also rejected claim 4 under 35 U.S.C. §103(a) as being unpatentable over Ma.

The present invention relates generally to techniques for fabricating passive transmission line devices, and forming such device in an integrated circuit. In one aspect, a passive transmission line device is formed in an integrated circuit. A recess insulating layer having a top surface and a bottom surface is formed. A recess, having walls and a bottom surface, is formed in the recess insulating layer. An enhancement layer, having substantial magnetic permeability or substantial dielectric permitivity or both substantial magnetic permeability and substantial dielectric permitivity, is formed covering the walls and the bottom surface of the recess. A conductive line is formed over the enhancement layer in the recess, the conductive line having an upper surface that does not extend laterally outside the recess.

In another aspect, at least one passive transmission line element is fabricated. An enhancement layer and a conductive layer material are sequentially deposited on a base structure that includes a bottom surface, a top surface, and at least one recess having a bottom recess surface and sidewalls, to provide a precursor structure having a top surface. The enhancement layer has a substantial magnetic permeability or substantial dielectric permitivity or both substantial magnetic permeability and substantial dielectric permitivity. The entire top surface of the precursor structure is etched over to completely remove the conductive layer material from regions that do not overlie the at least one recess

to provide at least one conductive line respectively disposed in the at least one recess, and each at least one conductive line having a respective top surface that is disposed over and does not extend laterally beyond its corresponding at least one recess, each at least one passive transmission line element comprising a respective at least one conductive line and a corresponding portion of the enhancement layer that overlies the corresponding at least one recess and that surrounds sides and bottom of the respective conductive line.

In yet another aspect, a passive transmission line device in an integrated circuit is fabricated. An insulating layer is provided. A damascene process is used to form the passive transmission line device in the insulating layer, the passive transmission line device comprising a conductive line and a first enhancement layer, the conductive line embedded in the first enhancement layer that covers the bottom surface and sidewalls of a recess formed in the insulating layer during the damascene process, the first enhancement layer having substantial magnetic permeability or substantial dielectric permitivity or both substantial magnetic permeability and substantial dielectric permitivity.

FORMAL REJECTIONS

In the Office Action, the Examiner objected to the specification regarding several typographical errors appearing therein. Applicant has amended the specification to address each of the Examiner's objections. Namely, on page 3, line 2 of the specification, Applicant has replaced "suite" with the corrected "suited," on page 9, line 19 of the specification, Applicant has replaced "art5" with the corrected "art," on page 9, line 22 of the specification, Applicant has replaced "geomet5ric" with the corrected "geometric" and on page 12, lines 9 and 10, Applicant has replaced "SiO2" and "Si3N4" with the corrected "SiO_2" and "Si_3N_4," respectively.

The Examiner further objected to claim 8 regarding claim language appearing therein. Applicant has amended claim 8 to clarify the wording thereof. Namely, at line 1, Applicant has amended the claim to recite "at least one passive transmission line element." At line 15, Applicant has added the term "said" to indicate a reference to each of the conductive lines. At line 18, Applicant has removed the term "of" to clarify reference to each passive transmission line element.

The Examiner has rejected claims 1-10 as being indefinite as under 35 U.S.C. §112, second paragraph. Namely, the Examiner alleges that the terms "substantial magnetic permeability" and "substantial dielectric permitivity," appearing in claims 1, 4, 8 and 10, render the claims indefinite. Applicant respectfully disagrees with the Examiner's assertions.

When a term of degree is presented in a claim, a determination is to be made as to whether the specification provides some standard for measuring that degree. M.P.E.P. §2173.05(b) Further, the court has held that the limitation "to substantially increase the efficiency of the compound as a copper extractant" was definite in view of general guidelines provided in the specification. *In re* Mattison, 509 F.2d 563, 184 USPQ 484 (CCPA 1975)

Such guidelines are clearly present in the present specification. For example, on page 14 of the specification it is indicated that materials having a relative permeability of at least about 2, e.g., more than about 10, are considered high permeability materials. These high permeability materials include, for example, ferrites. Further, on page 15 of the specification it is indicated that materials having a relative dielectric constant of at least about 7, e.g., more than about 15 or 20, are considered high permitivity materials. These high permitivity materials include, for example, $BaSrTiO_3$. Thus, the specification clearly sets forth a standard for determining degrees of permeability and permitivity.

The Examiner further rejected claim 2 under 35 U.S.C. §112, second paragraph, for reciting the limitation "said first insulating layer" without providing antecedent basis for the term. Applicant has addressed the Examiner's rejection by amending claim 2 to recite "an upper surface of a first insulating layer."

PRIOR ART REJECTIONS

As previously indicated, the Examiner rejected claims 1-3, 5, 6 and 8-10 under 35 U.S.C. §102(e) over Ma. Applicant respectfully traverses the rejection, for at least the reason that Ma fails to teach the use of an enhancement layer having substantial magnetic permeability or substantial dielectric permitivity or both substantial magnetic permeability and substantial dielectric permitivity, a limitation present in each of independent claims 1, 8 and 10.

The Examiner contended that insulating protect buffer layer 60, shown, for example, in FIG. 11 of Ma, may be considered an enhancement layer having substantial dielectric permitivity. This is simply not the case. Applicant directs the Examiner's attention to the instant specification, paragraph spanning page 15 – page 16, wherein high permitivity materials, such as $BaSrTiO_3$, are defined as those such materials having a relative dielectric constant of at least about 7, e.g., more than about 15 or 20. These high permitivity materials may be contrasted with low dielectric constant insulators that are typically used for interlevel dielectrics, such as silicon dioxide, silicon nitride, etc., having relative dielectric constants in the range of less than about 4 to about 7.

Ma, on the other hand, teaches that insulating protect buffer layer 60 and related metal-insulator-capacitor (MIM) insulating layer 62 comprise low dielectric constant insulators. For example, Ma teaches that insulating protect buffer layer 60 comprises silicon nitride, and MIM insulating layer 62 comprises silicon oxide having a dielectric constant of about 3.9. See Ma, column 7, lines 19-35 As such, Ma does not teach use of an enhancement layer having substantial dielectric permitivity.

Further, it is important to note that Ma also does not teach use of a high permeability material. According to the instant specification, paragraph spanning page 14 – page 15, high permeability materials, such as ferrites, include materials having a relative permeability of at least about 2, e.g., more than about 10. Ma does not teach use of such materials.

The Examiner has also rejected claim 4 under 35 U.S.C. §103(a) over Ma. The Examiner contends that while Ma does not teach use of a second enhancement layer over a conductive line, it would have been obvious to one of ordinary skill in the art to include a second enhancement layer, such as silicon nitride, as a passivation layer, to protect the structure. See Office Action, page 5, paragraph 6. Applicant respectfully contends that whether or not it is apparent to have a protective structure, Ma does not teach or suggest a second enhancement layer having substantial magnetic permeability and/or substantial dielectric permitivity, as is recited in claim 4.

As was highlighted above, Ma does not teach the use of high permitivity or high permeability materials. The Examiner even admits that ordinary skill in the art, given the teachings of Ma, would dictate that a low dielectric constant insulator, such as silicon nitride, employed, not a high permitivity or a high permeability material.

In view of the foregoing, the invention, as claimed in claims 1-10, cannot be said to be either taught or suggested by Ma. Accordingly, Applicant respectfully requests that the rejection of claims 1-3, 5, 6 and 8-10 under 35 U.S.C. §102(e) and the rejection of claim 4 under 35 U.S.C. §103(a) be withdrawn.

All of the pending claims, i.e., claims 1-10, are in condition for allowance and such favorable action is earnestly solicited.

If any outstanding issues remain, or if the Examiner has any further suggestions for expediting allowance of this application, the Examiner is invited to contact the undersigned at the telephone number indicated below.

The Examiner's attention to this matter is appreciated.

Respectfully submitted,

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